

## **Chapter 6.9 REGIONAL WATER QUALITY INITIATIVES**

### ***SOUTH CENTRAL REGIONAL OFFICE (SCRO)***

- **Total Maximum Daily Load (TMDL) Activities**

There are currently five (5) TMDL studies being conducted by SCRO water compliance and assessment staff. The projects are listed in detail below.

Nottoway River Basin – The project will address the bacteria impairments found in the headwaters of the Nottoway River, the Little Nottoway River, Big Hounds Creek and Beaver Pond Creek. The project is being coordinated with other regional offices to cover other parts of the Nottoway River Basin. The project is unique in that once the TMDL has been developed implementation planning will begin immediately.

Roanoke River Basin – There are currently two (2) TMDLs being developed for the Roanoke River Basin. The bacteria TMDL study will cover the entire Roanoke River Basin within Virginia. Technical Advisory Committee meetings and Public meetings will be held in conjunction with the West Central Regional Office (WCRO), to ensure adequate stakeholder involvement throughout the watershed. The PCB TMDL study will also cover the entire basin and be done in conjunction with WCRO. In 1999 & 2000 source identification work was completed in the Altavista and Brookneal areas. BGF Industries in Altavista was identified as a source of legacy PCB contamination. Remediation efforts are underway at the facility while additional source identification and monitoring is completed to support the study. The use of Semi-permeable Membrane Devices (SPMD), or virtual fish has provided data to complete the TMDL.

Great Creek (Mecklenburg County) – The load duration analysis method is being used to complete the bacteria TMDL. Sampling is currently being conducted and a Technical Advisory Committee will be assembled soon. Public meetings will be held in the future to ensure stakeholder involvement.

Flat Rock Creek (Lunenburg County) – The load duration analysis method is also being used to complete the bacteria TMDL for Flat Rock Creek. Sampling is currently being conducted and a Technical Advisory Committee will be assembled soon. Public meetings will be held in the future to ensure stakeholder involvement.

- **Lynchburg Watershed (H03) Pre-TMDL Study**

The SCRO has benefited from the help of local high school and college students in determining appropriate monitoring sites and potential sources for the upcoming bacteria TMDL. Jennifer Bragg, a Sweet Briar College senior, conducted road-crossing surveys during the 2004 fall semester. The surveys were used to document physical characteristics and potential sources of each site. The information was summarized by giving each site an overall ranking and whether up a follow-up by SCRO was needed. Several of the sites were monitored for bacteria by students at the Central Virginia Governor's School (CVGS). Lab methods and protocol were approved by the DEQ Quality Assurance Officer and results are used in the 2006 water quality assessment.

- **SCRO Water Quality Team and Community Involvement**

The SCRO Water Quality Team is comprised of regional monitoring, assessment and TMDL staff focused on the identification and restoration of impaired waters. A Water Quality Impact database was developed to track sources of potential impairments before they are identified through the assessment process. The database provides a proactive approach to correcting water quality problems in the South Central Region. The team has participated in Community Involvement Open House Meetings held around the South Central Region during 2004-2005. Displays presented information on water monitoring, benthic monitoring, water quality assessments, and TMDLs. The team has participated in other outreach events

such as the Holiday Lake 4-H Camp, the Sappony Tribe Camp, a booth at the Lynchburg Hillcats baseball game, guest lectures at local schools, and presentations for civic organizations.

- **Adopt-a-Stream: Blackwater Creek**

The SCRO has adopted a 2.8 mile segment of Blackwater Creek in Lynchburg. The segment is currently impaired for bacteria and the TMDL project is slated for development in 2008. A clean-up held in April 2004 yielded 3200 lbs. of trash, including 40 tires. SCRO has agreed to hold clean-ups on this segment twice a year.

## **VALLEY REGIONAL OFFICE (VRO)**

### **Shenandoah River Fish Kill**

A “chronic” fish kill resulting in the loss of an estimated 80% of the adult smallmouth bass and redbreast sunfish occurred in over 100 miles of the South Fork Shenandoah River between April and July 2005. Nearly identical fish kills were observed in the South Branch Potomac River in WV in 2002 and the North Fork Shenandoah River in 2004. Biologists with the Virginia Department of Environmental Quality (DEQ) and the Virginia Department of Game and Inland Fisheries (DGIF) and a number of other researchers have been investigating these fish kills, but have not been able to determine the cause(s).

Several unusual patterns have been found in these fish kills:

- The majority of fish lost were adult smallmouth bass and redbreast sunfish. Juvenile bass and sunfish seemed to be only lightly affected, if at all.
- Mortality was preceded in most cases by the formation of bacterial skin lesions, which progressed to the point that the fish finally died.
- The kills began in early spring and continued for 2-3 months. At any point in time, only low numbers of fish were dying, but, as noted above, the cumulative effect was very severe, killing approximately 80% of the adult smallmouth bass and redbreast sunfish.
- The kill area occurred throughout the entire lengths of the respective rivers, with no clear upstream or downstream boundaries.
- The sequence of the fish kills may suggest a geographic movement, with the first kill in the South Branch Potomac (WV) in 2002, the second in the North Fork Shenandoah (2004), and the third event in the South Fork Shenandoah River (2005).
- A recent, important finding that resulted from the fish kill investigations is the presence of a condition called fish intersex. This condition occurs when male individuals within a population take on female characteristics. In this case, male smallmouth bass have been found to have developing eggs within their testes. While not clearly related to the fish kill, this condition is indicative of environmental stress, possibly from estrogen-like compounds that are reaching our waterways.
- Unfortunately, **it appears that we are experiencing a repeat event in 2006**. Over the past several weeks, DEQ and DGIF have received reports of fish with lesions and dead fish in the North Fork of the Shenandoah River, mostly downstream of Woodstock, and in the lower reaches of the South River, near Grottoes and Port Republic.

These fish kills are truly mysteries. Fish pathologists at Virginia Tech and the U.S. Fish & Wildlife Service examined specimens during the 2005 fish kill and determined that these fish were being stressed by undetermined factors and the bacterial lesions were apparently a secondary effect. Review of water quality data did not indicate the presence of any chemicals at toxic levels, although routine samples are collected only once per month. Much of the concern from citizen callers focused on perceived impacts from agricultural, construction, and urban runoff.

There has been a very high level of interest in these fish kills from the news media, along with many citizens, river guides, environmental groups, and local, state, and federal agencies. DEQ and DGIF have maintained close contact with this diverse group of individuals and organizations over the last two years, both during and after the fish kills. To ensure a collaborative investigative and communication process, DEQ and DGIF formed the **Shenandoah River Fish Kill Task Force** in July

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2005. The Task Force includes representatives of state and federal agencies, agriculture, industry, riparian landowners, anglers, academia, and citizen environmental groups from the Shenandoah Watershed. The group's mission statement follows: To evaluate the potential factors resulting in fish lesions and mortality, with a goal of identifying causative agent(s) and communicating our findings to those who can promote or implement corrective actions.

The Task Force has met monthly since July 2005 and has identified a number of possible causes for the fish kills, along with strategies for investigating these possible causes. In October 2005, **Shenandoah Pure Water Forum** (<http://www.cisat.jmu.edu/projects/forum/forum.htm>) hosted a **Shenandoah River Fish Kill Conference** at James Madison University in Harrisonburg. This conference featured a public forum, attended by well over 100 people.

Following the Conference, the Shenandoah River Fish Kill Task Force identified several high priority areas of study. Based on anticipated funding from the General Assembly, the Task Force has proposed one of the most comprehensive and intensive studies of a watershed within Virginia. Specific elements are outlined below.

- DEQ has initiated a 4-month water sampling plan on the Shenandoah River starting in March. This plan includes sampling daily at 9-10 stations and several times per day during storm events to capture the effects of significant runoff. The agency will test for nutrients, ammonia, temperature, dissolved oxygen and other parameters to determine how changes in environmental conditions may affect the health of the fish.
- Scientists from the U.S. Geological Survey's Fish Health Lab in Leetown, WV, and U.S. Fish & Wildlife Service's Fish Disease Lab in Lamar, PA, in cooperation with DGIF, have begun a comprehensive evaluation of fish health in the Shenandoah. The agencies plan to collect fish from a number of locations the Shenandoah River, examine each specimen and its body organs in the field, and also analyze blood and internal tissues in the laboratory. These analyses will attempt to document signs of stress from a variety of sources, including disease, parasites, and a wide range of pollutants. Fish collection efforts began the week of March 27, 2006, and included specimens which were clearly under stress (including fish with lesions) and fish in apparent good health.
- The USGS Office of Water Resources in Richmond is initiating an "around the clock" monitoring effort at one site each on the North and South Forks of the Shenandoah in early April 2006. This study will conduct "real-time" monitoring of ammonia (hourly analyses) and continuous physical water measurements, including pH, dissolved oxygen, temperature, conductivity, turbidity, and river flow.
- DEQ also plans to expand coverage of potential pollutants that may concentrate in fish tissue. As part of DEQ's routine monitoring of metals and pesticides in fish tissue, a number of samples were collected from the Shenandoah drainage during the 2005 fish kill. Members of the Task Force are attempting to identify chemicals not usually addressed in DEQ's analyses and will add these to the list of contaminants to be measured in these samples. [Expected cost: \$6,000]
- Several university studies addressing ecological and climatological assessments are scheduled for the summer 2006 period.
  - o Virginia Commonwealth University – Genomic DNA pathogen evaluation
  - o James Madison University – climatological and hydrologic data assessment
  - o Virginia Tech – benthic invertebrate sentinel indicator study

The above studies will be completed by the end of the summer of 2006. At that time the Task Force will meet and evaluate all results and identify any areas needing continued or additional study.

For more information and details on the Shenandoah River fish kills and the activities of the Shenandoah River Fish Kill Task Force, see DEQ's web site and related links at <http://www.deq.virginia.gov/info/srfishkill.html>.

### **The South River Science Team**

The South River and the South Fork Shenandoah River have been under fish consumption advisories since the 1970s, when mercury was discovered in the system. The current advisory extends from the South River in Waynesboro to Front Royal on the South Fork Shenandoah River. It is believed that the primary source of the mercury in the system is from past (pre-1950) disposal and operational practices at the DuPont Waynesboro plant. Supported by a trust fund from a 1984 settlement between the State Water Control Board and DuPont, DEQ conducts regular monitoring of fish, sediments, and water and shares the results with VDH to ensure that data are accurate and the public is informed of risks from fish consumption. The most recent DEQ fish sampling results can be found on the DEQ web site at <http://www.deq.virginia.gov/fishtissue/mercury.html>.

Since November 2000 the DEQ Valley Regional Office has been participating in a unique partnership with industry, other state agencies, local officials, academia, and citizen groups. This group is referred to as the **South River Science Team**. The goal of this group is to look beyond the routine long-term mercury monitoring conducted in the South River by DEQ. Areas of focus include filling data gaps, reviewing new technologies, addressing outstanding risk-based questions, evaluating the potential for remediation, and ensuring that there is effective communication between stakeholders.

Cooperating organizations include:

- DEQ
- DuPont
- DGIF
- VDH
- James Madison University
- Eastern Mennonite University
- Virginia Tech
- VIMS
- Friends of the Shenandoah
- Isaac Walton League

The South River Science Team meets 4-6 times per year to share data, discuss ongoing monitoring and research efforts (both within and beyond the South River area), and prioritize needs for future mercury-related work in the Shenandoah River basin. In addition to regular representation from the groups identified above, the group also invites several internationally recognized mercury experts to an annual fall meeting for the purposes of sharing case studies and seeking advice on details of planned work.

Highlights of the South River Science Team during 2005 include the following:

- Continued collaboration with stakeholders, along with interaction with internationally-renowned experts in mercury research
- Surface water trend monitoring and bimonthly sampling by DEQ, using low-level methods, allowing detection at much lower concentrations than those measured historically
- Fish tissue sampling for mercury at 17 locations
- Continuation by DEQ and other researchers of intensive, closely-spaced water sampling efforts in the Waynesboro – Doods area to evaluate whether there may be continuing input of mercury to the river.
- Ongoing evaluation of sediments and soils along South River
- Evaluation of mercury uptake in crops grown in areas of mercury-contaminated soils

Support and oversight of South River mercury research projects by several universities, including studies on periphyton, river geomorphology, and mercury uptake in avian species along the river.

## **NORTHERN VIRGINIA REGIONAL OFFICE (NVRO)**

### **Probabilistic Biomonitoring and Chemical Monitoring Program in Virginia Non-Tidal Streams**

The NVRO has participated in the DEQ's Probabilistic Monitoring Program since its inception in the spring of 2000. This program consists of three sampling components: a thorough examination of the benthic macroinvertebrate community utilizing the EPA's Rapid Bioassessment Protocols, sampling a full suite of chemical parameters in water and sediment, and a physical habitat evaluation at each station. The stations are biologically sampled twice a year. Chemical sampling is performed each spring in conjunction with biological monitoring and the physical habitat evaluation is conducted each fall when the biological monitoring is performed. In 2004, the NVRO sampled seven probabilistic stations in both the spring and fall for a total of 14 sampling events. Eight stations were sampled in calendar year 2005, again each station being sampled once in both the spring and fall, for a total of 16 sampling events. Finally, as part of the probabilistic program, the DEQ participated in a grant study with the National Academy of Sciences to collect data on periophyton/algae in freshwater systems in 2004.

### **Total Maximum Daily Load (TMDL) Activities**

#### Special Study Monitoring in Support of Bacteria TMDL Development

Since the publication of the 2004 Integrated Report, the NVRO established 51 special study water quality monitoring stations on selected streams identified in the 1998 or 2002 §303(d) *Total Maximum Daily Load Priority List and Report*. The special studies were designed to provide monitoring data used to better define the impaired stream segments and to support TMDL development. Between July 2003 and August 2004, 25 stations were sampled monthly, with 13 stations being used for the extensive Bacterial Source Tracking (BST) test method. Similarly, 21 stations were sampled monthly between July 2004 and August 2005, with ten stations being utilized for the BST test method. Each sampling event included water quality samples for fecal coliform and *E. coli* bacteria.

#### Special Study Monitoring of the Occoquan Embayment

The NVRO initiated a long term water quality monitoring project in the Occoquan River tidal embayment in the spring of 2005. A portion of the Occoquan River embayment is currently identified in the §303(d) impaired waters list as not supporting the aquatic life use due to excursions outside the water quality criteria range for pH. To better characterize the water quality in the Occoquan River tidal embayment, water quality measurements were made using fixed continuous monitors and grab samples. The water quality monitoring for this study was conducted from April to October 2005. The primary objective of this study was to collect monitoring data throughout the warm season to better characterize the water quality and provide detailed monitoring data to support development of a TMDL. A secondary objective of this study was to provide continuous monitoring data to enable a more accurate assessment of the new Chesapeake Bay water quality criteria for dissolved oxygen, water clarity, and chlorophyll.

Data were collected using YSI Model 6600 EDS multi-meters. These instruments were configured to measure and store water temperature, pH, dissolved oxygen, turbidity, and chlorophyll measurements in fifteen-minute increments. In addition to the continuous monitoring with the YSI sondes, water column grab sampling, light attenuation, and Secchi depth measurements were performed at each of the stations where the continuous monitors were deployed.

#### Special Study Monitoring in Support of the Tidal Potomac River PCB TMDL

Portions of the tidal Potomac River, from the mouth to the head of tide, have been identified by Maryland, Virginia, and Washington, DC as impaired due to elevated levels of polychlorinated biphenyls (PCBs) in fish tissue samples. The DEQ is currently participating in a multi-jurisdictional project initiated to address the elevated PCB levels in the tidal Potomac River. The project, which is coordinated by the Interstate Commission on the Potomac River Basin (ICPRB), allows Washington, DC, Maryland, Virginia, and the U.S. EPA to develop a TMDL for PCBs in the Potomac River estuary, including the Virginia embayments.

Development of the tidal Potomac River TMDL aids Virginia's plan to achieve and maintain the applicable water quality criteria for PCBs, designed to protect human health from the harmful effects of eating contaminated fish. Fish tissue samples collected throughout Virginia's tidal waters in the Potomac River basin regularly contain PCB concentrations at levels that exceed thresholds established by the Virginia DEQ and the Virginia Department of Health (VDH). Additional information on fish tissue sampling and results can be obtained at <http://www.deq.virginia.gov/fishtissue> and <http://www.vdh.virginia.gov/HHControl/fishingadvisories.asp>.

The DEQ began working with neighboring jurisdictions and the ICPRB to plan and organize for the Potomac River PCB TMDL study in late 2003. Once the agreement to work through the ICPRB was established, U.S. EPA federal grant funds to initiate development of the TMDL were sought and received in 2004. Water quality monitoring to support TMDL development consisted of the deployment of semi-permeable membrane devices (SPMDs) in 26 locations, including both free-flowing streams and tidal portions of Virginia's waters. Sediment sampling was performed at 16 sites and water column grab sampling was performed at 11 locations. In addition to the ambient PCB monitoring, 11 point source discharges in the tidal Potomac River drainage were sampled. All samples were analyzed using an ultra low detection level for PCB congeners. This TMDL study is on-going.

#### Completed and Planned TMDLs

Since the completion of the 2004 Integrated Report, ten TMDL reports covering 18 impaired segments have been completed by the NVRO and approved by the U.S. EPA. A Bacteria TMDL for Deep Run (Fauquier County and Stafford County) was approved by the EPA on May 26, 2004. Bacteria TMDLs for Limestone Branch and Piney Run (Loudoun County), Muddy Run (Culpepper County), Cedar Run and Licking Run (Fauquier and Prince William County) were approved by the EPA on July 6, 2004. Carter Run and Great Run (Fauquier County) Bacteria TMDLs were completed and approved on March 10, 2005. Bacteria TMDLs for the York River Basin streams flowing into Lake Anna were approved by the EPA on November 11, 2005. Streams listed in the York River Basin TMDL include Terrys Run, Pamunkey Creek, Beaver Creek, Mountain Run (all in Orange County), Gold Mine Creek (Louisa County), and Plentiful Creek (Spotsylvania County). A Bacteria TMDL for Mountain Run and Mine Run (Orange County and Culpepper County) was completed and approved on November 15, 2005, while another for the Robinson River and Little Dark Run (Madison County) was approved on December 12, 2005.

A Bacteria TMDL for the Pamunkey River Basin was submitted to the EPA on May 1, 2006. Streams in the Northern Virginia Region that are accounted for in this report include Taylors Creek (Louisa County) and two portions of the South Anna River (Orange County and Louisa County). Benthic TMDLs were developed for Bull Run (Fairfax County and Prince William County), Popes Head Creek (Fairfax County and the City of Fairfax), and South Run (Fauquier County and Prince William County) and submitted for approval in May 2006. Finally, a Bacteria TMDL for streams in the Occoquan River watershed was developed and submitted for EPA approval in May 2006. Streams in this TMDL report include Popes Head Creek (Fairfax County and the City of Fairfax), Broad Run (Prince William County), Little Bull Run (Prince William County), Kettle Run (Prince William County), South Run (Fauquier County and Prince William County), Bull Run (Fairfax County and Prince William County), and the Occoquan River (Prince William County).

#### TMDL Implementation Plan Development

In addition to developing TMDLs necessary to continue with the increasing pace of the Consent Decree Schedule, the NVRO assisted with the development of several bacteria TMDL implementation plans. Since the completion of the Four Mile Run Implementation Plan on June 17, 2004, two additional Implementation Plans have been developed in the Northern Region of Virginia. The Catoctin Creek (Loudoun County) Implementation Plan was approved by the State Water Control Board on June 28, 2005, and the Carter Run, Great Run, Deep Run, and Thumb Run (Fauquier County and Stafford County) Implementation Plan is currently wrapping up the public comment period. The implementation process involved intense coordination between state and federal agencies, local governments, and citizen groups.

In the Carter Run, Great Run, Deep Run, and Thumb Run implementation process, major emphasis was placed on discussing best management practices (BMPs), locations of control measures, education, technical assistance, monitoring, and funding.

## **Lake Anna Monitoring**

### Regular Lake Monitoring

The NVRO and the DEQ Central Office staffs have worked with representatives of the Lake Anna Civic Association (LACA) to develop a coordinated water quality monitoring plan for Lake Anna. The LACA organized a Water Quality Program in July 2000, which began monitoring 13 sites on the lake beginning in February 2001. This LACA monitoring program expanded to include 20 sites. The DEQ has conducted its own water quality monitoring on the lake, as well, but these two monitoring programs, historically, have been conducted without coordination. In the winter/spring of 2002, the DEQ and the LACA worked to develop a monitoring plan for the lake that is implemented using the combined resources of the NVRO and the citizen volunteers. This combined monitoring effort began with the first coordinated lake sampling event in 2002. The monitoring plan incorporates a three-year sampling rotation where the DEQ will monitor approximately one-third of the sites on the main lake each year. The LACA volunteers will monitor those lake stations that the DEQ does not sample. The collaborative monitoring effort allows more extensive lake water quality monitoring than could be achieved individually by either the DEQ or the LACA. The DEQ monitoring is conducted in accordance with the DEQ lake monitoring guidance, and the LACA citizen monitoring is conducted in accordance with a DEQ-approved quality assurance plan.

### Investigation of Elevated PCB Levels in Fish Tissue

Due to elevated levels of PCBs in fish tissue, a fish consumption advisory has been issued by the VDH for Lake Anna. This advisory updates the 303(d) impaired waters listing from 2004, which applied only to selected portions of the lake. As a result of the elevated levels of PCBs in fish tissue and the potential for metals contamination from the historical mining activities along Contrary Creek, a federal appropriation was granted through *§206 of the Water Resources Development Act of 1996* to undertake a Preliminary Restoration Plan, or Feasibility Study, for Lake Anna. Sampling for Phase I of the study was performed in the late summer and fall of 2004 and included sediment and water column sampling throughout the lake and in free-flowing tributaries. The water column assessment was performed using SPMDs. Phase II sampling was performed in the summer of 2005 and included concentrated sediment sampling utilizing high resolution gas chromatography and mass spectrometry to achieve low detection limits for PCB congeners. The investigation is on-going and is being implemented cooperatively through the U.S. Army Corps of Engineers, the Virginia DEQ, the LACA, and other federal and local partners.

## **WEST CENTRAL REGIONAL OFFICE (WCRO)**

### VIRGINIA ROANOKE RIVER BASIN ADVISORY COMMITTEE (VRRBAC) AND THE ROANOKE RIVER BASIN BI-STATE COMMISSION

WCRO personnel have served as administrative staff for the Virginia Roanoke River Basin Advisory Committee (VRRBAC) since December of 2002. DEQ staff and other State Agency employees have made numerous presentations to VRRBAC to inform members about the issues of the Basin.

VRRBAC was established in the executive branch of state government as an advisory committee to the Virginia delegation to the Roanoke River Basin Bi-State Commission. The Roanoke River Basin Bi-State Commission was established and composed of members from the Commonwealth of Virginia and the State of North Carolina. The purpose of the Commission in short is to safeguard the Roanoke River Basin's natural resources for the citizens of the Roanoke River Basin. This duty includes providing guidance, making recommendations, identifying problems, disseminating information, and promoting communication, coordination, and education among stakeholders. NC has passed similar legislation. The advisory committees of both States assist the Roanoke River Basin Bi-State Commission fulfill its responsibility.



A goal of VRRBAC is to open channels of communication. The Committee meets throughout the Roanoke basin in an effort to be available to all basin constituents. It is important that dialogue take place which is representative of all areas of the basin. There must be rural and urban cooperation on water issues. Speakers representing various groups, State Agencies, Local Governments, different geographic areas, and interests have addressed VRRBAC. Localities and State entities have provided meeting facilities for the meetings. Such participation demonstrates that VRRBAC has strong partnerships in the region, which helps in carrying out the work of the Committee. Broad public support of policy and regional consensus is the best way to bring about positive change associated with environmental and related health issues. Better efficiency of protection efforts will result as all partners, public, private, federal, state, and local officials, can share and leverage resources. Such coordination and consensus building in the entire basin on watershed management issues is essential to sound watershed decision making and management. Sub-committees have been given direction to promote such an effort using broad-based input consolidated from as many interested parties as possible.

The sub-committees formed are Agriculture and Forestry, Lake Interests, Municipal Interests and Permit Holders, River Interests, and Water. The sub-committees are to prepare position papers on important issues and bring them back to the full Committee for adoption. An effort is being made to bring the most knowledgeable people possible to the table, where the work must take place. The objective is to obtain membership that will represent stakeholders throughout the basin and maintain a geographical and urban/rural balance.

Since the inaugural meeting of VRRBAC certain characteristics and issues of the basin have become evident. The importance of natural resources to the economic vitality of the Basin is apparent. People reside in and come to the Roanoke River Basin area to pursue various interests including vacation, lifestyle, esthetics, boating, fishing, etc. These activities and personal values help drive the economic engine of the local and regional area. In addition, agriculture is vital to the region's lifestyle and economy. Clean water and ample flow and supply are recognized as essential to existing beneficial uses and future economic growth. There are interrelationships within the basin involving flow, as events in one section of the basin can impact other parts. Environmental, ecosystem, human health, power generation, aquatic life, and economic needs of the basin must be balanced. The generally good water quality of the Roanoke basin is valued and must be preserved. Issues and topics which are crucial to the well-being of the basin people include 1.) Inter-basin transfer of water, 2.) Water withdrawals, 3.) Regulation of flow and storage, 4.) Invasive species, 5.) Recreation and fishing, 6.) Water quality and 7.) Lake vitality.

VRRBAC has adopted several positions regarding the Basin's natural resources. It supports the implementation of BMPs and other strategies such as Low Impact Development (LID) and Nutrient Management Plans to correct pollution problems. VRRBAC favored the development of a Virginia State-wide Water Policy, but only one that mandated local stakeholder input and was against the inter-basin transfer of water that is detrimental to the people of the basin. VRRBAC is opposed to any new water withdrawal until such time that the real and potential needs for the foreseeable future are determined.

For more information please see the VRRBAC website at <http://www.deq.virginia.gov/vrrbac/>.

### **TMDL STUDIES IN WCRO**

WCRO completed many TMDL studies during the 2004-2006 biennium including the Roanoke River watershed, Pigg River watershed, and Beaverdam Creek watershed. WCRO partnered with the Roanoke-Allegheny Regional Planning District Commission for the Roanoke River watershed study. WCRO managed one TMDL implementation plan study (Stroubles Creek) and assisted VDCR in several implementation plans (Big Otter River, Lower Blackwater River, Mill Creek and Dodd Creek). WCRO monitoring staff has provided TMDL data support at over 50 TMDL stations, 8 TMDL implementation plan stations, and collected data at 17 Bacteria Source Tracking (BST) stations.

### **PCB SOURCE INVESTIGATIONS IN THE NEW RIVER VDH FISH CONSUMPTION ADVISORY AREA (2002 – 2004)**



From 2002 – 2004, an intense search for PCB sources has been underway in the New River watershed from Claytor Lake Dam (upstream and outside the Advisory Area) to the Virginia-West Virginia State line near Glen Lyn. The investigation involves extensive review of VA DEQ agency records, interviews of local officials, citizens, industry representatives, and information provided by the New River PCB Source Study Citizen's Committee. Based on these interviews and follow-up onsite inspections, DEQ teams sampled soil and sediment from multiple areas in the New River Valley in the fall of 2003. The investigation incorporates approximately 50 sites of sediment and soil samples. Laboratory analytical results are pending.

#### LAKES MONITORING ONGOING

WCRO has five large lakes, which are primary recreational waters. WCRO continues to sample these high value waters several times a year to track water quality. In recent years these data have proven to be valuable due to high citizen concern over water quality in these lakes. In 1999, we began sampling six months each year. These data are and will be used in future Integrated Reports.

#### ***SOUTHWEST REGIONAL OFFICE (SWRO)***

- Construction has begun on the Northern Tazewell County Regional Wastewater Treatment Plant. A long-standing water quality issue will be resolved with the construction of this facility, which will serve the Town of Pocahontas, where an aging sewerage system has contributed to bacteria and benthic macroinvertebrate impairments in Laurel Creek.
- Amonate is a very small community of approximately 50 homes situated in a narrow valley along the banks of Beech Fork in northern Tazewell County near the Virginia/West Virginia border. The community was originally a bustling coal mining camp owned by Pocahontas Fuel Company that over the years evolved into a residential community of privately owned single-family homes. Many of the residents are now retired and on fixed incomes. Until recently, the community lacked a public wastewater collection and treatment system, and wastewater generated in the homes discharged directly to Beech Fork. An innovative wastewater collection and treatment system has changed this. The new system includes septic tanks at each residence, a small diameter wastewater collection line, and a recirculating sand filter. The new plant went in service in January of 2006 and final connections were made to the system in May 2006. Funding was provided through an EPA grant that was administered by the DEQ Construction Assistance Program. Additional grant funding was provided by DHCD and the Tazewell County Board of Supervisors. Total cost of the project was \$1,160,075.
- Similar decentralized sewage systems are in planning stages for the Rose Hill community in Lee County with approximately 130 homes that discharge into Martin Creek and for the Exeter community in Wise County with approximately 140 homes that discharge into Pigeon Creek.
- Batie Creek was originally listed as impaired in 1998 because dissolved oxygen levels violated water quality standards. In 2006, Batie Creek was removed from the TMDL list due to successful implementation of solid waste removal that included cooperation between several state and federal agencies. Diurnal DO now meets the dissolved oxygen standard.
- In an effort to increase public outreach and enhance environmental awareness in the region, an Environmental Education Specialist position was created in 2005. Christine Smith has conducted teacher training, visited numerous classrooms and participated in environmental outreach events. Her efforts have brought environmental education to hundreds of local citizens.
- Rosenbaum Feeder Cattle, LLC is located in Washington County, Virginia near the confluence of Hutton and Plum Creeks. Both of these streams are impaired due to fecal coliform contamination and the general standard for aquatic life. The source of the impairment is NPS-Agriculture. The Rosenbaums are actively involved in a voluntary Ag-BMP Project that when completed, will result in a management change that will benefit water quality. With this project, they are eliminating poorly sited and open feedlots by constructing two large covered loafing areas complete with covered manure storage facilities. Total cost of the project is approximately \$940,000, and is funded through the DEQ Ag-BMP low interest loan program.

#### ***PIEDMONT REGIONAL OFFICE (PRO)***

- **Dragon Swamp Mercury Source Assessment**

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Portions of Dragon Run/Dragon Swamp, and the Piankatank River were initially placed under a Virginia Department of Health fish consumption advisory in 2003 due to excessive mercury in largemouth bass discovered during year 2000 fish tissue monitoring by the DEQ. The advisory was expanded in July 2005 to cover the entire length of Dragon Run/Dragon Swamp after further monitoring by the DEQ.

The fish consumption advisory recommends that adults should not eat any more than two meals/month of largemouth bass. High-risk individuals such as women who are pregnant or may become pregnant, nursing mothers, and young children are advised not to eat any fish contaminated with mercury from the respective advisory areas. High levels of mercury in the bloodstream of unborn babies and young children may harm the developing nervous system.

To determine the source of the mercury, the Piedmont Regional Office of the DEQ began a source assessment study in 2004 which will continue through 2006. The study includes monitoring mercury levels in water and bottom sediments of 13 locations throughout the Dragon Swamp watershed. It is suspected that the mercury contamination is entering this system primarily from atmospheric deposition. The objective of this study is to examine patterns of mercury distribution within this watershed. The study hypothesis is that if atmospheric deposition is the source of mercury, levels of total mercury will be evenly distributed through out this watershed. If local "hotspots" or areas of comparatively elevated levels of total mercury are found, they may be an indication of local ground-based sources of mercury entering the system.

The results of the first years monitoring showed no locations standing out as relatively higher than the rest of the watershed (i.e. no obvious "hotspots" were found). Most samples (88%) were below the laboratory detection level of 1.5 parts per trillion (ppt). The highest value measured 6.14 ppt, which was well below the EPA human health standard for public drinking water supplies (50 ppt) and more than 100 times lower than the chronic aquatic life water quality standard of 770 ppt.

The results of the first year of this study do not indicate any evidence of a local ground source of mercury contributing to the observed contamination in this system.

- **Tyson Foods, Inc. Glen Allen Ammonia Study**

Data analysis in summer 2005 showed elevated ammonia levels in an unnamed tributary of the Chickahominy River below the Tyson Foods permitted discharge. The ammonia levels exceeded the allowable chronic 30-day average water quality standard, however the data was limited to instantaneous grabs, so comparison to the chronic standard was not possible.

DEQ performed a study in July-August 2005 to determine if ammonia levels exceeded chronic water quality standards in the stream. Samples were taken at 7 locations on the tributary, including upstream and downstream of the discharge, in a downstream pond, and below the dam. Samples were taken daily Monday-Thursday to allow better comparison to the 30-day average standard. During this month-long study, acute and chronic ammonia violations, pH violations, and maximum temperature violations were noted at various locations. In addition, two separate fish kills were documented during the study; one of the fish kills coincided with an unanticipated wastewater treatment plant bypass that caused exceedences of permit limits for total phosphorus and total suspended solids in the effluent.

Based on the results of the ammonia study, Tyson Foods has initiated an upgrade to their wastewater treatment plant.

- **James River Park Bacteria Study**

The 2002 303(d) list of impaired waters listed the James River through Richmond as impaired of the Recreation Use because of exceedences of the monthly geometric mean for fecal coliform. There is a dearth of real-time fecal coliform bacteria data available for the public to use in making decisions regarding the recreational use of the James River within James River Park in Richmond. Therefore

beginning in August 2002, the Department of Environmental Quality and James River Park joined forces to expand the water quality monitoring conducted in the James River during the summer months.

Staff and volunteers from the park collected water samples to be tested for fecal coliform bacteria on a regular schedule from five locations on the river where there is heavy recreational use. The sites are listed below:

Ponypasture  
42nd Street in the river  
Texas Avenue Beach  
Belle Isle just above Hollywood Rapid  
Tredegar Iron Works

The water was sent to state laboratories for analysis funded by DEQ, and results are posted on the DEQ web site. The study was continued through 2005. During 2006, monitoring at these stations was conducted once per month by DEQ as part of the James River TMDL study and once per month two weeks after DEQ by James River park staff.

- **Defense Supply Center (DSCR) Study**

The Defense Supply Center of Richmond (DSCR) is a large federal material storage and distribution facility that is subject to numerous state and federal environmental laws and regulations. In addition, this facility has an active Superfund project to contain and clean up contamination from past operations on the site. The Virginia Department of Environmental Quality (DEQ) interacts with this facility on a regular basis to ensure that they comply with all applicable environmental rules.

Upon learning of public concerns about TCE (trichloroethylene) contamination in water leaving the site, DEQ staff performed a special study in 2002 to determine whether there was unusual contamination in the small stream (referred to as No Name Creek) that receives stormwater runoff from the Defense Supply Center of Richmond (DSCR). The study involved taking water samples from the stream during and immediately following rainfall events, and testing for bacterial contamination, TCE and other contaminants. Analysis of the samples indicated low levels of TCE and some other contaminants; however, the concentrations were well below any established human health risk levels. Special tests were performed to determine if bacteria found in the samples came mostly from animal or human sources. Human bacteria contamination from failing septic tanks was noted in the stream. Chesterfield County subsequently decided to expand their sewerage service area to include Rayon Park, a residential community adjacent to DSCR and No Name Creek.

In addition to the water chemistry analysis, a good indicator of pollution in a stream is the amount and diversity of aquatic life that exists there. A biological stream assessment was conducted in No Name Creek by a DEQ aquatic biologist. The findings indicated that the stream had aquatic organisms that were typical for a small stream in an urban area. There was no indication of unusual biological impacts.

- **Harmful Algal Bloom Response and Monitoring Program**

The DEQ maintains fixed monitoring stations and investigates fish kills to determine whether they are caused by algal blooms, and, if so, to determine whether toxic *Pfiesteria*-like organisms (PLO) are present. Many fish kills are juvenile menhaden kills which are typically attributed to low dissolved oxygen and stranding overnight at low tide. In most instances no lesions are observed on these fish, PLO counts are low, and DNA probe results are negative. However, fish kills are often caused by both toxic and non-toxic algal blooms. In its early stages, the blooms elevate dissolved oxygen (DO) and pH, and as the bloom dies, DO can drop to hypoxic levels resulting in fish and crab kills. In addition, PLO and other toxic algae can cause lesions on fish and have been tied to health effects in fisherman.

At the monitoring sites, DEQ collects dissolved oxygen, pH, temperature, and a full range of water quality analyses - including dissolved, particulate and total phosphorus and nitrogen, urea, chlorophyll *a*, biochemical oxygen demand, total suspended solids, and total organic carbon. Algae samples are

collected by the DEQ and are sent to Old Dominion University for identification and Pfiesteria-Like Organism (PLO) algal cell counts, and are sent to the Virginia Institute of Marine Science (VIMS) for DNA probe identification.

### **Specific Investigations:**

In 2004, PRO monitoring staff investigated a prolonged *Microcystis auruginosa* bloom in the Potomac River at Colonial Beach from June 25 to July 4. On the evening of June 24, a bright blue-green paint-like material was noted in the Potomac off the Colonial Beach riverfront. The material came onshore with the flood tide and reports indicated that some children had developed rashes on their backs. PRO staff began investigating on June 25<sup>th</sup> and Colonial Beach officials closed the beach to swimming. By June 28, there were 1.8 million cells/ml *Microcystis* in the Potomac River less than 10 meters from the Colonial Beach shoreline off the end of Colonial Avenue and analysis indicated 3 ppb Microtoxin in the beach area. Colonial Beach had re-opened the beach to swimming on Sunday July 27<sup>th</sup>, but closed it again on June 28.

By June 30<sup>th</sup>, the sample at the end of Colonial Avenue had 4000 cells/ml, with a Microtoxin value < 0.5 ppb; however, there was a pocket of heavy HAB further down the beach. The cell count was 1.9 million cells/ml with 1100 mg/m<sup>3</sup> chlorophyll a, and a Microtoxin concentration of 3 ppb. There was concern that with the tidal movement the most dense bloom area could move anywhere along the beach.

PRO staff continued to monitor the bloom throughout the holiday weekend, due to the tourism that was expected at the beach. By Saturday and Sunday July 3 and 4, analysis indicated < 500 cells/ml, with a Microtoxin value below detection of 0.5 ppb at several locations along Colonial Beach. The bloom appeared to be over and Colonial Beach removed the posting signs on July 4.

In 2005, PRO staff investigated nine incidents, including two juvenile menhaden kills, a filamentous blue-green algae bloom near Hopewell, and several dinoflagellate red tide blooms. On September 29<sup>th</sup> – October 9<sup>th</sup>, PRO monitored a blue-green *Anabaena* bloom in the James River near Scottsville, which is approximately 65 miles upstream from the City of Richmond. There was concern about possible taste and odor problems in Richmond's drinking water supply if the bloom reached the intake. However, tropical storm Tammy flushed the bloom past the city of October 9<sup>th</sup>. No fish kill was reported.

On April 1, 2006, PRO responded to a report of skin rashes and lesions from water exposure in the Potomac River near Colonial Beach. Old Dominion University identified low levels of diatoms and no toxic dinoflagellates. The rashes and lesions were reported to the Virginia Department of Health. A possible red tide bloom was noted 10 miles upstream.

- **Coastal 2000 Initiative - Water Quality, Biomonitoring and Sediment Toxicity of Virginia Estuaries**

PRO and TRO have sampled randomly selected probabilistic estuarine stations on the western and eastern Chesapeake Bay shores and the oceanside of the Eastern shore from summer 2001 to 2005. Probabilistic studies answer questions such as "What percentage of Virginia estuaries have low dissolved oxygen?" Sampling crews obtain filtered chlorophyll a and nutrients, particulate nutrients, total suspended solids, benthic infauna, sediment metals, organics, particle size, and toxicity samples, light attenuation data, and depth profiles for DO, temperature, pH, conductivity and salinity. Each station is sampled once. Field duplicate samples are collected at one station per run, to cover 10 percent of samples for each parameter. Hydrolabs are pre- and post-calibrated and maintained according to agency SOPs. The results of the study are incorporated into the 305(b) assessment.

- **Probabilistic Biomonitoring and Chemical Monitoring Program in Virginia Non-Tidal Streams**

In 2001, DEQ initiated the Probabilistic Monitoring (ProbMon) study. The aim of ProbMon is to provide accurate statewide and regional assessments of the conditions of Virginia's freshwater streams. A total of 50 streams ranging in size from first order to sixth order is sampled statewide annually. Of these, PRO

has annually sampled approximately 15 randomly selected probabilistic non-tidal stream stations in the Piedmont and Coastal Plain ecoregions. The Regional Biologist gathered representative samples of benthic macroinvertebrates, performed comprehensive habitat assessments, and obtained DO, temperature, pH, and conductivity data. Each station was sampled twice, once in the spring and again in the fall. Fall sampling includes water quality samples for nutrients, solids, chlorophyll a and fecal coliform bacteria. Hydrolabs are pre- and post-calibrated and maintained according to agency SOPs. Using this 2001-2004 data, a Virginia Stream condition Index has been developed and validated and the results of the initial five-year study have been summarized and are available for review at [www.deq.virginia.gov/probmon/](http://www.deq.virginia.gov/probmon/). The program is expected to continue and it is estimated that over 600 locations will be sampled by 2010.

## **TIDEWATER REGIONAL OFFICE (TRO)**

### **The Elizabeth River Program**

In 1997, in response to indications of toxic impairment of water quality in the Elizabeth River and its tributaries, DEQ and a group of Elizabeth River Project stakeholders collaborated to produce a comprehensive WQM plan for the water bodies of concern. Under guidelines included in that plan, a baseline environmental study began in January 1998, with the goal of allowing the future assessment of trends in contaminant concentrations and their effects. Scientists from the Virginia Institute of Marine Science, Old Dominion University, and the Department of Environmental Quality are working with representatives from state, federal, and local authorities and other stakeholders to design and conduct this monitoring effort.

Several activities that have been continued under this initiative are described below.

#### **Conventional Pollutants / Nutrients**

DEQ and ODU continue to monitor for these parameters, which include dissolved oxygen, nitrogen, phosphorus, pH, salinity and temperature. This monitoring, while done previously at a limited number of stations, was expanded to 14 stations in 1998 and now includes depth profiles and significantly more detailed nutrient analysis. Although the stream conditions regarding nutrients and dissolved oxygen are still degraded, monitoring trends show significant improvements at many locations in the river ( <http://www.chesapeakebay.odu.edu/Reports/reports.htm>). Data can be viewed and downloaded from the Chesapeake Bay Information System (CIMS) at <http://www.chesapeakebay.net/wquality.htm>.

#### **TBT Monitoring**

Dr. Mike Unger, from the Virginia Institute of Marine Science, has collected Tributyltin (TBT) data at 18 Stations in the Elizabeth River, Hampton Roads and the lower James River six times a year since August 1999. Only rarely have non-detectable (less than 1 part per trillion) levels of TBT shown up in these data. The highest measured concentrations occurred on September 20, 2001 with several stations near the confluence of the Eastern and Southern Branches of the Elizabeth River exceeding 20 ng/L; the highest measured concentration was greater than 70 ng/L at a station in the Southern Branch. Although the chronic standard (1.0 pptr) is regularly exceeded in all branches of the Elizabeth River except the Western Branch, no exceedence of the acute standard (360 pptr) has been observed. A summary of the monitoring results can be viewed at [http://www.vims.edu/env/projects/tbt\\_deq/](http://www.vims.edu/env/projects/tbt_deq/).

#### **Benthic Index of Biotic Integrity (BIBI) monitoring**

Dr. Dan Dauer (Old Dominion University) initiated a study of the macrobenthic communities of the Elizabeth River watershed in summer 1999 as a means of characterizing the health of the benthic communities of the Elizabeth River watershed. A probability-based sampling design allows calculation of confidence intervals for estimates of condition of the benthic communities and allows estimates of the geographic extent of degradation of the benthic communities. Based upon probability-based sampling, the estimate of bottom substrate not meeting the benthic restoration goals was  $64 \pm 10.1\%$  in 1999,  $72 \pm 17.6\%$  in 2000,  $52 \pm 19.6\%$  in 2001,  $72 \pm 17.6\%$  in 2002,  $80 \pm 15.7\%$  in 2003, and  $88 \pm 12.7\%$  in 2004. Average B-IBI values for the Elizabeth River watershed were 2.7, 2.6, 2.7, 2.4, 2.3 and 2.2, respectively for the years 1999-2004. In general for the Elizabeth River watershed, species diversity and biomass were below reference condition levels, while abundance was above reference condition levels.

Community composition was unbalanced, with levels of pollution-indicative species above, and levels of pollution sensitive species below reference conditions.

Copies of relevant Elizabeth River Monitoring Reports are available at the ODU Web pages on the Internet at <http://www.chesapeakebay.odu.edu/Reports/reports.htm>.

### **Harmful Algal Blooms/Pfiesteria Monitoring**

The Department of Environmental Quality and the Department of Health, including the Division of Shellfish Sanitation, work together to regularly monitor the water and shellfish growing areas for the presence of harmful algal blooms (HABs, including Pfiesteria). A fixed station monitoring network is sampled monthly from May through November by DEQ for water quality conditions. Samples from the sites are sent to Old Dominion University and the Virginia Institute of Marine Science for a detailed evaluation for potential harmful algae species. DEQ also investigates algal blooms and fish kills that may be associated with harmful species. Additional information can be found at <http://www.vdh.state.va.us/epi/dzee/waterborne/HABS.asp>.

### **Coastal 2000 Initiative**

The Tidewater Regional Office has been involved with the Coastal 2000 Program. Data has been collected from 2001 through 2005. For additional information, see the reference made under PRO: Coastal 2000 Initiative - Water Quality, Biomonitoring and Sediment Toxicity of Virginia Estuaries. Additional Coastal 2000 program information can be found in Chapter 2.1.